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Using WEPS with Measured Data

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Introduction

The Wind Erosion Prediction System (WEPS) is designed to simulate soil loss by wind from cultivated fields by simulating weather and field conditions (Wagner, 1997). However, in some situations, WEPS may be run using measured or simulated data from other models. This is typically done to validate various components or submodels of WEPS, particularly the erosion portion of the model. For example, a user may have measured soil loss data and limited weather and soil data. They can then input the measured weather and soil data to compare the model soil loss with the measured loss. Some users may also wish to use WEPS in a "predictive mode" where measured, "real time" field data is used in conjunction with weather predictions to estimate future soil loss from fields. This paper will explore the use of WEPS with measured or other simulated data.

WEPS is a process-based, continuous, daily time-step model that simulates weather, field conditions, and erosion. It has the capability of simulating spatial and temporal variability of a field's soil, crop, and residue conditions and soil loss/deposition within a field. The saltation/creep, suspension, and PM10 components of eroding material are also reported separately and by direction. The WEPS model is modular in design with submodels that simulate weather, soil conditions, crop growth, residue decomposition, management operations, and soil loss by wind. It is designed to be used by the USDA-NRCS, under a wide range of conditions throughout the U.S. However, with proper inputs, WEPS is easily adapted to other parts of the world.

Procedures

In typical applications, input files are created within the user interface that makes these files available to the science portion of the model to calculate field conditions and erosion. WEPS requires several types of information to complete a simulation run. However, these files can be modified with measured data and input into WEPS under certain constraints. All of these files except the management file, may be easily altered using a standard text editor or the WEPS user interface to reflect measured data. All input files must be formatted to meet the requirements for WEPS (USDA-ARS-WERU, 2001). A description of these input files and considerations for there creation with measured data are listed below. See the WEPS User Manual (USDA-ARS-WERU, 2001) for detailed description of each input file.

- **Run** file (default is 'weps.run') - This file contains general information for a simulation run including the dates of the simulation, the field and barrier

dimensions, the field location, and the path and names of the other input files (described below). The 'run file' parameters can be modified to match the parameters for the field simulated. The list of the other input files should specify the path and name of measured data to be used. This file also contains comments (indicated by a '#' in column one) which describes each line of input data to aid in checking and modifying input data.

- **Weather** files - WEPS runs are made for multiple years in full year increments beginning on January 1. If only a partial year of weather data is available (typical), the user has two options. One is to substitute measured data within the simulated weather file and observe the output for the period with measured data. The other option is to use the stand alone Erosion model (described below) for single day simulations. Two weather files are required for the full WEPS model.

  Windgen file (default is '*.win') - This file contains both the wind speed (m s^{-1}) on a subdaily time step and one wind direction (degrees clockwise from North) for each day of the simulation. The subdaily wind speeds are by default the average hourly speeds (i.e., 24, 1 hourly averages) but can be of other time steps of equal length (e.g., 96, 15 minute averages or 8, 3 hour averages).

  Cligen file (default is '*.cli') - The Cligen weather generator was developed for use with the Water Erosion Prediction Project (WEPP) (Flanagan, et.al., 2001) and is used by WEPS to simulate other weather parameters. The input file created by Cligen includes precipitation amount (mm), duration (hr), time to peak (fraction of duration), and peak intensity (mm hr^{-1}) as well as maximum and minimum air temperature (□C), solar radiation (ly d^{-1}), and dew point temperature (□C). This file also contains historical monthly averages for maximum and minimum temperature (□C) which are required by WEPS.

- **Soil** file (default is '*.ifc') - This file contains the initial soil conditions at the start of a simulation run. The soil and management submodels then simulate the changes in these conditions as affected by weather, management, and erosion for each simulation day. Even intrinsic parameters such as particle size distribution will change with tillage as layers are mixed. If simulated soil parameters vary significantly from measured values, it is recommended that the user use the stand alone Erosion model (described below). The soil input file includes the taxonomic order, number and thickness (mm) of soil layers, detailed particle size distribution (fraction), wet and dry bulk density (Mg m^{-3}), aggregate stability (ln(J m^{-2})), density (Mg m^{-3}), and size distribution (fraction), soil crust properties (varies), random and oriented (ridge) roughness (mm), soil water characterization parameters (varies), dry albedo (fraction), organic matter (fraction), pH, calcium carbonate (fraction), and cation exchange capacity (meq $100g^{-1}$). This file also contains comments (indicated by a '#' in column one) which describes each line of input data to aid in checking and modifying input data.

- **Management** file (default is '*.man') - This file contains parameters for the

manipulation of soil and biomass properties as a result of various management operations performed on the field on a given date. These operations include planting, harvesting, cultivation, defoliation, fertilization, and irrigation. The management file should only be altered using the Management Crop Rotation Editor for WEPS (MCREW) to guarantee that parameters are correct. MCREW is accessed through the WEPS user interface.

The Erosion submodel can also be operated as a stand alone model to simulate erosion for a single storm (i.e., daily). A stand alone erosion model user interface has been created and is available for easy input of parameters, run the model, and view outputs. Input parameters that must be provided for the day include the field and barrier dimensions as well as biomass, soil, hydrology, and weather parameters. Wind speed can be entered either as Weibull distribution parameters or listed as average wind speeds for each time period throughout the day. Specific definitions of these parameters are documented within the user interface.

For assistance using measured data with WEPS or to obtain the WEPS model or the standalone Erosion model, please go to {http://www.weru.ksu.edu/weps} or contact one of the authors at the e-mail addresses listed above.

References

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